

Instruction Manual

Encoder Distribution Unit

Model

NCR-XAACD3A

Preface

Thank you for adopting this device. Before use, please read this manual carefully to fully exploit the performance of this device.






Precautions in safety

Before installation, wiring, operation, maintenance and inspection, and error diagnosis and countermeasures, carefully read this manual and all other related operating instruction manuals for proper usage.








Before use, be sure to fully acquaint with the equipment, safety information, and other related precautions.

Safety precautions are ranked as "Danger" and "Caution".




And contents to follow are ranked as "Prohibition" and "Compulsion".

 Danger	If mishandling is made, dangerous situation as death or serious injury on a worker could occur.
 Caution	If mishandling is made, dangerous situation as medium or light injury could occur and damages on goods could be suspected. However, since  Caution-marked item could also cause serious results depending on the actual conditions, please comply with the important instructions.
 Prohibition	Prohibitions (actions not to be done) are indicated.
 Compulsion	Compulsions (actions to be done) are indicated.




Precautions in handling

 Danger		
 Compulsion	<ul style="list-style-type: none"> ● Be sure to ground the earth terminals or earth cables of this device. ● Use the earth cable specified in this manual, or a thicker cable than that, for the D-class grounding or better. ● Execute relocation, wiring, maintenance, and inspection after five minutes or more of the power-off. 	Electric shock may occur.
 Caution		
 Prohibition	<ul style="list-style-type: none"> ● Never use this device in the atmosphere such as water splash, corrosive or flammable gas, nor place it close to combustible materials. 	Fire or failure may occur.
 Prohibition	<ul style="list-style-type: none"> ● Since temperatures of the motor, this device, and peripheral equipment rise high, do not touch them. ● In supplying power or for a while after shutting power off, since this device could be very hot, do not touch them. 	Burn may occur.
 Compulsion	<ul style="list-style-type: none"> ● Use the motor and this device in the specified combination. 	Fire or failure may occur.
 Compulsion	<ul style="list-style-type: none"> ● Never conduct voltage withstanding test and Mega test of this device. 	Failure may occur.







Storage

 Caution		
 Prohibition	<ul style="list-style-type: none"> Do not store this device in a place of raining, water dripping, and harmful gas and liquid. 	Failure may occur.
 Compulsion	<ul style="list-style-type: none"> Store this device in a place avoiding direct sunlight under controlled temperature and humidity within the range specified in this manual . Be sure to contact our sales representative when the storage period after purchase has passed more than three years. 	Failure may occur.



Transportation

 Caution		
 Prohibition	<ul style="list-style-type: none"> Do not hold a shaft when handling the cable in transportation. 	Injury or failure may occur.
 Compulsion	<ul style="list-style-type: none"> Piling up or overloading the products can induce collapse of cargo; thus, follow instructions. 	Injury or failure may occur.


Installation

 Caution		
 Prohibition	<ul style="list-style-type: none"> Do not climb or put any heavy thing on this device. 	Injury or failure may occur.
 Prohibition	<ul style="list-style-type: none"> Do not apply heavy shock. 	Equipment may be damaged.
 Compulsion	<ul style="list-style-type: none"> Never block air-intake/exhaust windows and do not allow foreign substance to go in. Be sure to install this device to the specified directions. Attach this device to a non-flammable thing as metal. 	Fire may occur.
 Compulsion	<ul style="list-style-type: none"> Distance of alignments between this device and the internal walls of control panel and other equipment should follow the measurements specified by this manual. 	Fire or failure may occur.
 Compulsion	<ul style="list-style-type: none"> Perform proper mounting suitable for the output or weight of this unit. 	Equipment may be damaged.




Wiring

 Danger		
⚠ Compulsion	<ul style="list-style-type: none"> To avoid electric shock and noise influence, be sure to make proper grounding (earth). 	Motor runaway, electric shock, injury, or machine damage may occur.
 Caution		
⚠ Compulsion	<ul style="list-style-type: none"> Be sure to conduct correct wiring. 	Motor runaway or burnout, injury, or fire may occur.
⚠ Compulsion	<ul style="list-style-type: none"> To avoid the impact of noise on this device, use cables having the adequate length and features (shielded, twisted, and other treatments) specified by this manual. For the control input/output (I/O) signal line of this device, prepare another line system separate from other power cables and motor power cables. 	Motor runaway, injury, or machine damage may occur.

Operation and run

 Caution		
⊘ Prohibition	<ul style="list-style-type: none"> Since excessive adjustment can make the operation unstable, avoid this situation. 	Injury or machine damage may occur.
⊘ Prohibition	<ul style="list-style-type: none"> Do not turn on the power in the condition where the motor shaft is in rotation or in vibration. 	Motor runaway, injury, or machine damage may occur.
⚠ Compulsion	<ul style="list-style-type: none"> Check the power specifications are normal. 	Injury, fire, or machine damage may occur.
⚠ Compulsion	<ul style="list-style-type: none"> Install an emergency stop circuit externally, to stop operation instantly and shut off the power. For trial run, fix the motor, check this device and motor only for operation, and then attach them to the machine. When alarm happened, be sure to remove the cause after reset, and then restart. 	Injury or machine damage may occur.

Maintenance and inspection

 Caution		
 Prohibition	<ul style="list-style-type: none"> Overhaul/repair shall be conducted only by us or personnel designated by us. 	Failure may occur.
 Compulsion	<ul style="list-style-type: none"> Be sure to use the device in the range of stipulated environmental temperature and humidity. 	Unusual operation and failure may occur.
	<ul style="list-style-type: none"> The device lifetime has a close relation with the temperature in use. Note that a use under the high temperature and high humidity environment may shorten the device lifetime. Generally, it is said that an increase of 10°C in temperature can shorten the lifetime of equipment to half. The capacitance of the main circuit electrolytic capacitor inside the device decreases due to deterioration. To prevent secondary accidents due to failures, it is recommended to replace it in about five years. Consult our sales representative. 	Failure may occur.

Precautions before installation (during transportation)

During transportation, please handle with care so as not to damage the device.

*Caution

- Do not pile up devices and do not put any item on the cover.
- Do not move this device by holding its cable.
 - Doing so may damage cable disconnection.

Cautions in storage

If the products are not used soon after receiving, store them under the following conditions in order to prevent deterioration of insulation and rust formation. However, unpack the packages, soon after receiving and check any damage and other non-conformances incurred during transportation.

Storage conditions of the device

Item		Description
Ambient condition	Temperature	-20°C to +60°C
	Humidity	85% or less (non-condensing)
	Storage location	Store in a clean place free from dust and dirt. Do not store them in a harmful atmosphere such as corrosive gas, grinding fluid, metal powder, and oil.
Vibration		Store in a place free from vibration.
Others		If you store the product for a long period of time, conduct rust prevention treatments and carry out periodic inspection.

Precautions in transportation

When it is necessary to transport the products after receive, satisfy following conditions.

Transporting conditions of the device		
Item		Description
Ambient condition	Temperature	-20°C to +60°C
	Humidity	85% or less (non-condensing)
	Storage location	Do not transport the products in a harmful atmosphere such as corrosive gas, grinding fluid, metal powder, oil, etc.
Vibration		0.5 G or less (device)

About this manual

This manual explains installation, wiring, way of use, maintenance and inspection, error diagnosis, and countermeasures about the device.

In order to use this device correctly, deeply understand the contents of this manual.

At the time of installation, wiring, operation, maintenance and inspection, and in other works, follow the conditions and procedures described on this manual.

When using a customized device, read this manual and the specification document for the customized device.

However, the specification document prevails over this manual, if description and items are overlapped.

- The contents of this manual are subject to change without prior notification in future.

Warranty period

Warranty period of our products is one year after shipment from our factory.

However, please note that any failure or error resulting from the following causes is not covered by the warranty.

- ① Modification by parties other than us.
 - ② Nonstandard operation different from rules and regulations stipulated by this manual.
 - ③ Natural disasters.
 - ④ Connection with another maker's unit which is not approved by us.
- Warranty of this device is limited for repairing only. Any damage caused by the fault of delivered device, or lost opportunity on the customer's side, profit loss, secondary damage, and accident will not be covered.
 - Regardless of the warranty period, please inform our sales person whenever you find any failure or error.

Caution

- Our products have been designed and manufactured for the aim of the general purpose applications in the general industry. The products are not intended to be used in any equipment and system that may involve human life. If, therefore, they are used in any other use, we shall not assume any responsibility whatsoever. (Examples: Uses that are expected to have a significant influence on human life and property, such as in nuclear energy, aerospace, and medical equipment and systems and passenger cars)
- When installing the product to a facility that may involve serious accidents and loss by excessive exterior noises or failure on the motor, install the back-up and fail-safe functions systematically.
- If used under the conditions where sulfur or sulfide gas is produced, splitting due to corrosion on the tip resistors or poor connection on the contacts can occur.

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Chapter 1 Outline

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1-1 Features

This device is for distributing the A-phase, B-phase, and Z-phase (encoder marker signals) of the 90 deg phase difference signal input from the pulse encoder to the driver and peripheral equipment.

It has features such as the following:

Features of the encoder distribution unit

- ① Signals from the incremental pulse encoder are output to two systems, driver and peripheral equipment.
- ② Output signals to the driver are exactly the same as input signals from the incremental pulse encoder. For magnetic pole signals, signals input in line driver form and single-pole pulse command form are output in line driver form.
- ③ Output signals to the peripheral equipment can be frequency-divided with appropriate switch settings to output them at reduced frequencies. The frequency dividing rate can be selected from 1/1, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, and 1/256.
- ④ If a disconnection is detected between this device and the encoder, the output signal to the peripheral equipment is set to high impedance.

Note: Single-pole pulse command form mentioned in ② is supported by device Rev.3.00 or later.

1-2 System configuration

A system configuration example of this device is shown in Figure 1-1 System configuration example of the encoder distribution unit.

* In the figure, the NCR-HB Series is used as an example.

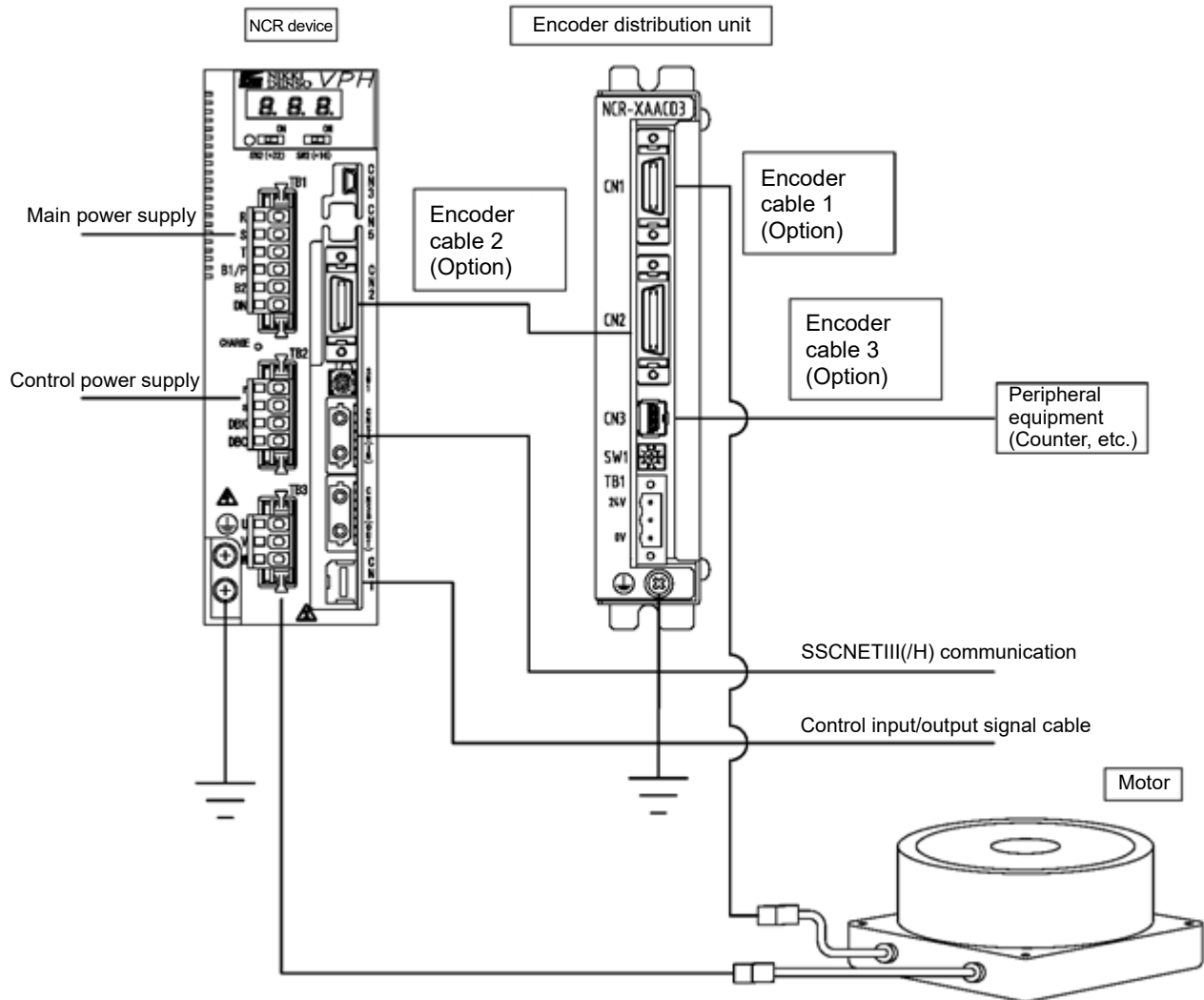


Figure 1-1 System configuration example of the encoder distribution unit

Chapter 2 Specifications

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2-1 General specifications

Table 2-1 General specifications lists the general specifications of this product.

Table 2-1 General specifications

Item		Description
Outline		Refer to Chapter 5 Outline.
Ambient condition	Temperature	Operating temperature 0 to 50°C Storage temperature -20 to 60°C * ¹
	Humidity	80% or less, no condensation. * ¹
	Sea level	1000 m or less
	Installation location	Do not install in any harmful atmosphere including corrosive gas, grinding oil, metal dust, and oil.
Cooling method		Natural cooling
Mounting method		Panel mount type
Vibration resistance		Acceleration 5.9 m/s ² (10 - 50 Hz) No resonance

*¹ Temperature and humidity conditions greatly affect lifetime. Thus, avoid the use under a high temperature and high humidity condition.

2-2 Electrical specifications

Table 2-2 Electrical specifications lists the electrical specifications.

Table 2-2 Electrical specifications

Item			Description/Specification
Power input			<ul style="list-style-type: none">When the external power supply is not used: 5 VDC (+4.85 to +5.35 V) 0.3 A (Provided from the driver. Excluding the power supply for the encoder.)When the external power supply is used: 24 VDC ±5% 0.1 A (The power supply for the encoder is provided from the connected driver.)
Input signal *1	Encoder pulse, marker	Type	Line receiver (equivalent to 26LS32)
		Signal style	90° phase difference signal Maximum input frequency: 5 Mpps (during multiplication by 4: 20 Mpps)
		Number of signals	Numbers of A-, B-, and Z-phase signals: 1, respectively
		Connection specifications	Output form: Line driver (equivalent to 26LS31)
	Magnetic pole sensor	Type	Comparator
		Signal style	90° (2-phase) or 120° (3-phase) phase difference signal Maximum output frequency: 1460 pps * For connection in line driver form, the positive pole side is connected to the input signal of the comparator and the negative pole side is connected to the offset signal of the comparator.
		Signal level	0 to +5.35 V (5 VDC)
		Number of signals	Numbers of HA-, HB-, and HC-phase signals: 1, respectively
		Connection specifications	Output form: Single-pole pulse command, line driver (equivalent to 26LS31)
Output signal 1 *2	Encoder pulse, marker	Type	Encoder pulse input signals and marker input signals are output as they are.
	Magnetic pole sensor	Type	Line driver (equivalent to 26LS31)
		Signal style	90° (2-phase) or 120° (3-phase) phase difference signal Maximum output frequency: 1460 pps
		Number of signals	Numbers of HA-, HB-, and HC-phase signals: 1, respectively
		Connection specifications	Input form: Line receiver (equivalent to 26LS32)
Output signal 2 *3	Encoder pulse, marker	Type	Line driver (equivalent to 26LS31)
		Signal style	90° (2-phase) or 120° (3-phase) phase difference signal Maximum output frequency: 1460 pps
		Number of signals	Numbers of A-, B-, and Z-phase signals: 1, respectively
		Destination specifications	Input form: Line receiver (equivalent to 26LS32)
Power supply for the encoder			5 VDC/250 mA MAX
Weight			Approx. 210 g
Accessory			Power plug terminal × 1

*1 Connection cable length: 20 m or less

*2 Connection cable length: 1 m or less

*3 Connection cable length: 3 m or less

Note: Single-pole pulse commands are supported by device Rev.3.00 or later.

2-3 Power supply-related specifications

The power supply-related specifications to apply if the external 24 VDC power supply is used are listed in Table 2-3 Power supply on/off timing specifications. The timing is shown in Figure 2-1 Power supply timing.

Table 2-3 Power supply on/off timing specifications

Item	Time [mSec]
ton	2000 or greater
toff	0 or greater

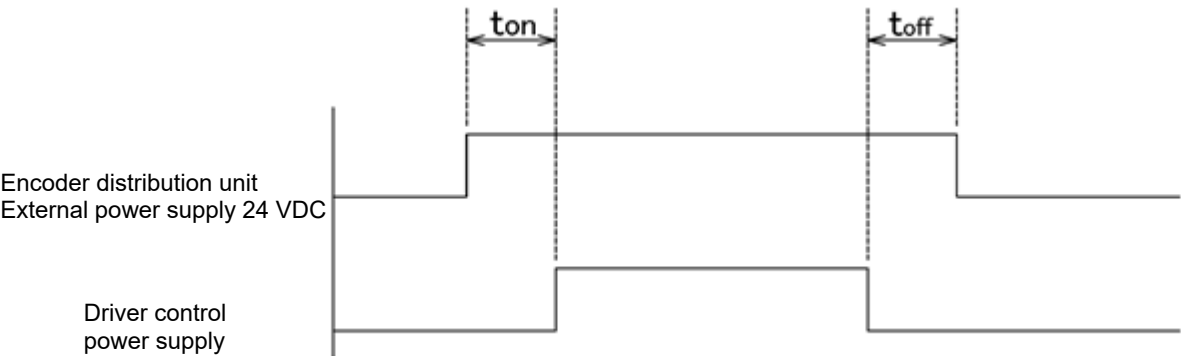


Figure 2-1 Power supply timing



Caution

To use the external 24 VDC power supply, strictly observe the contents of this chapter.
If operated outside the range of the specifications, the device does not operate normally.

Chapter 3 Installation

3-1 Incoming check.....	3-2
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3-1 Incoming check

At the time of delivery, check the following:

- ① Correct products as you ordered? (Model, etc.)
- ② No damages during transportation? (If no breakages in the package and no exterior abnormalities on products)
- ③ Found all accessories?
Accessory: Power connector plug: MSTB2.5/3-STF-5.08 (Phoenix Contact)

If found any short shipment or damages, please contact our sales representative immediately.



Caution

If found damages on the package such as a cardboard box, please contact our sales representative without opening the package.

3-2 Installation environment

The installation environment for this device is described below.

- (1) For information about the ambient conditions for the device, refer to 2-1 General specifications.
- (2) The device lifetime has a close relation with the temperature in use. A use under the high temperature and high humidity environment may shorten the device lifetime. Generally, it is said that an increase of 10°C in temperature can shorten the lifetime of equipment to half.
- (3) For the temperature inside the storage control panel, consider the surrounding temperature and the temperature increase due to the equipment inside the panel. Be sure to keep the surrounding temperature of the device within the permissible range.
- (4) This device is naturally cooled. Secure a space so that ventilation due to convection is not hindered. To install the device adjacent to other devices, do so by referring to 3-3 Installation method.
- (5) If there are nearby heating elements and vibrating sources, prepare an appropriate construction against the influence.
- (6) Do not install the product in a place of high temperature and high humidity or in places where excessive dust particles, metal powder, and cloud of steam exist, and in an environment where corrosive gas exists.
- (7) If there is a noise generation source nearby, reinforce the grounding treatment. Depending on the use conditions, take noise protection measures.



Caution

Use this device under the ambient conditions contained in 2-1 General specifications.
Negligence may result in errors and failures.

3-3 Installation method

The installation method for this device is described below.

- (1) Be sure to install the device in the vertical direction to secure normal heat radiation effect.
- (2) Space around the device must be secured with the distances specified in Figure 3-1 Encoder distribution unit installation example from other devices in view of heat radiation efficiency and maintenance easiness.
- (3) The mounting methods for this device are shown in Figure 3-2 Encoder distribution unit mounting example.

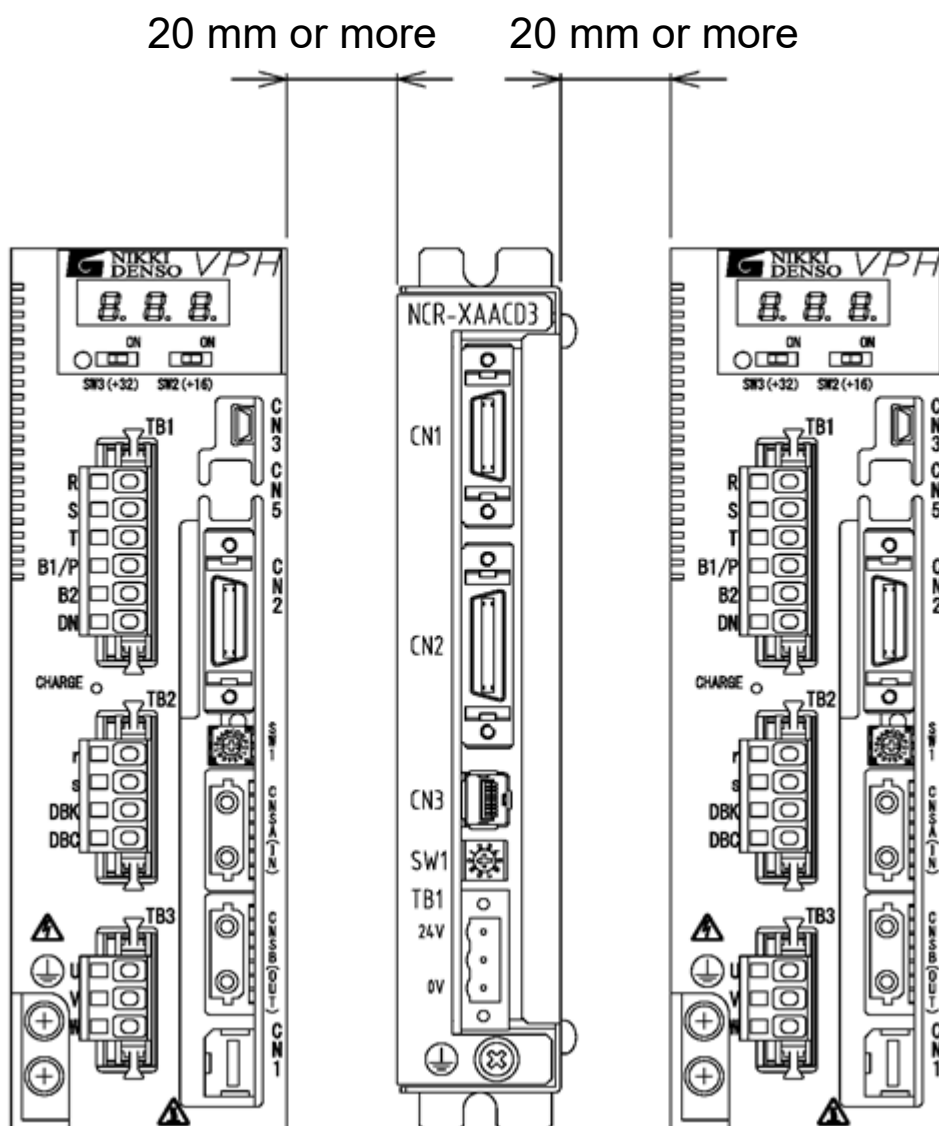


Figure 3-1 Encoder distribution unit installation example

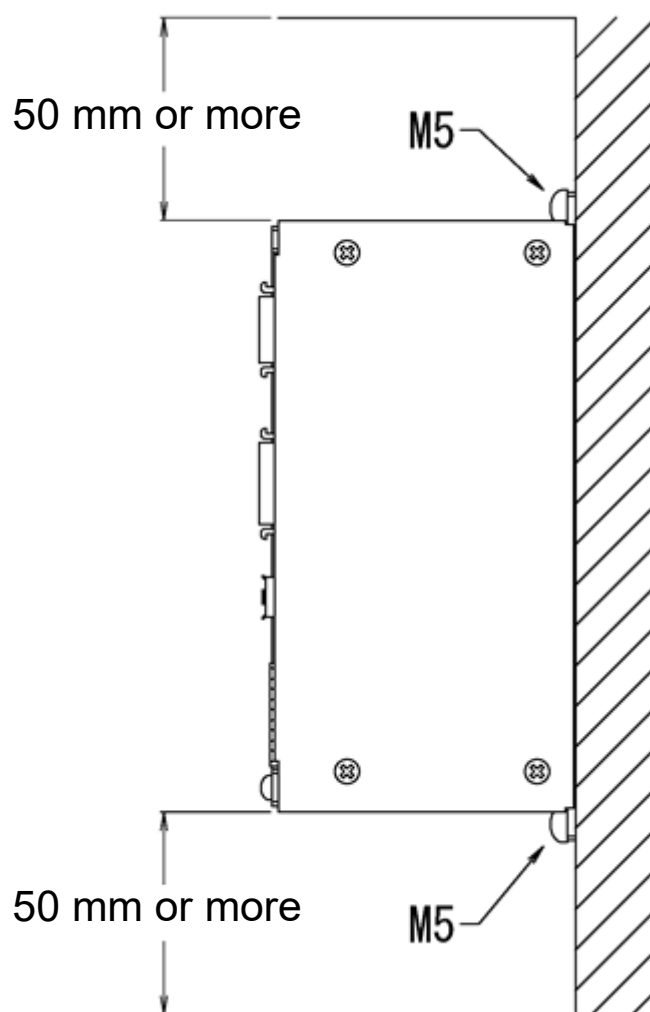


Figure 3-2 Encoder distribution unit mounting example

Chapter 4 Signal connection

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4-1 Power supply connection

The power supply of this device is described below.

- (1) For information about the power supply specifications for this device, refer to 2-2 Electrical specifications.
- (2) To use the external 24 VDC power supply, use wire AWG20 to AWG15.



Caution

- Be very careful not to make a connection to the power supply erroneously. Otherwise, the device may be damaged.
- Be sure to strictly keep the range of specifications for the power supply. If used outside the range of the specifications, the device may be damaged.
- Prepare special power supply for the device apart from the power supply for other high-power equipment when possible.
- To use the device near a noise generation source, take noise protection measures for the power line.

4-2 Grounding

The grounding of this device is described below.

- (1) Be sure to ground for electric shock prevention and noise protection measures.
- (2) The wire to use for grounding must be AWG14 or greater.
- (3) Connecting the grounding wire to the earth terminal of the device (Ⓔ in 5-2 Name of each part).
- (4) Use exclusive grounding. If common grounding is used, be sure to apply one-point grounding.



Caution

- To decrease common mode noise and to prevent erroneous run of the device, grounding should be the exclusive grounding and better than D-class grounding (grounding resistance 100 Ω or less).
- If exclusive grounding is impossible, secure one-point common grounding to commonly ground with other equipment at the grounding spot.
- Be sure to avoid common grounding with high-power equipment and grounding to steel frames.
- Route the earth cable carefully so that it will not be looped.

Signal connection

4-3 External connection

The external connection of this device is shown in Figure 4-1 External connection diagram.

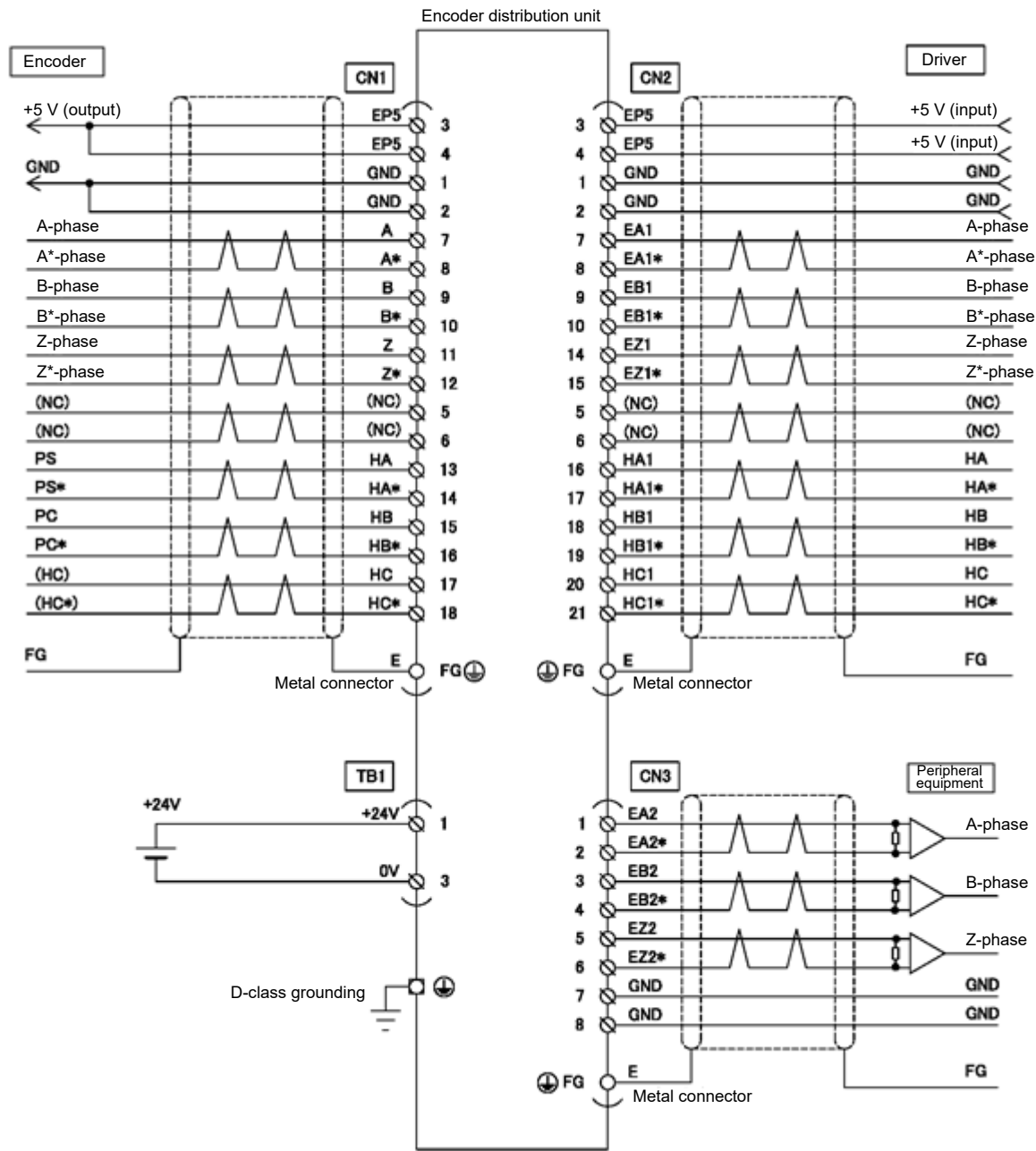


Figure 4-1 External connection diagram

4-4 Input/output interface

The input/output interface of this device is described in Table 4-1 to Table 4-5.

Table 4-1 Input/output interface (1/5)

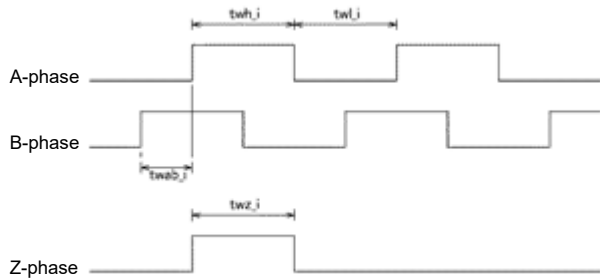
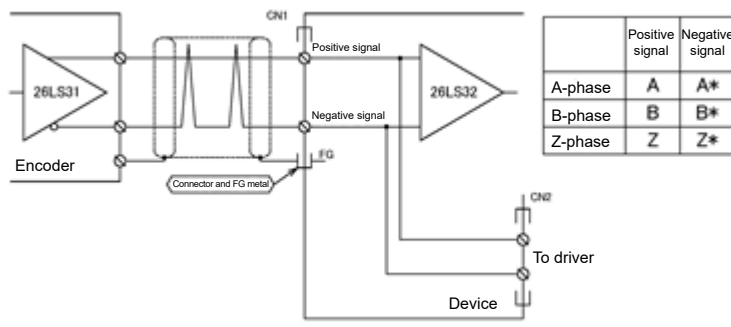
Connector	Electrical specifications												
CN1	<ul style="list-style-type: none">The direction effective when the B-phase precedes the A-phase is assumed to be the positive direction.Minimum input pulse width [twh_i · twl_i] for A-phase and B-phase must be 80 ns or more.Minimum edge distance between A-phase and B-phase [twab_i] must be at least 40 ns.Minimum input pulse width [twz_i] of encoder marker signal (Z-phase) must be 500 ns or more. <div></div>												
Corresponding signal													
Encoder feedback pulse input A,A* B,B* Z,Z*													
Equivalent circuit													
<div><table data-bbox="1171 994 1362 1135"><tr><th></th><th>Positive signal</th><th>Negative signal</th></tr><tr><td>A-phase</td><td>A</td><td>A*</td></tr><tr><td>B-phase</td><td>B</td><td>B*</td></tr><tr><td>Z-phase</td><td>Z</td><td>Z*</td></tr></table></div> <ul style="list-style-type: none">Be sure that encoder feedback pulse is line driver (equivalent to 26LS31) output.			Positive signal	Negative signal	A-phase	A	A*	B-phase	B	B*	Z-phase	Z	Z*
	Positive signal	Negative signal											
A-phase	A	A*											
B-phase	B	B*											
Z-phase	Z	Z*											

Table 4-2 Input/output interface (2/5)

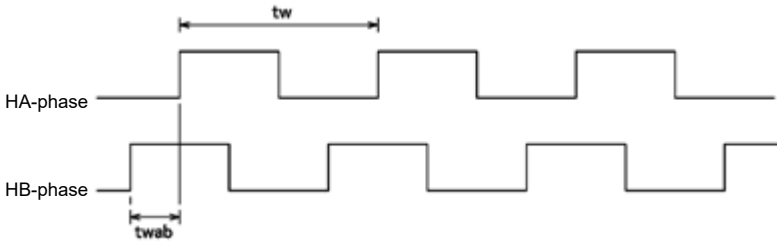
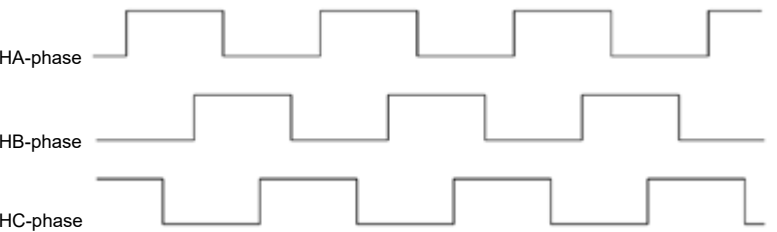
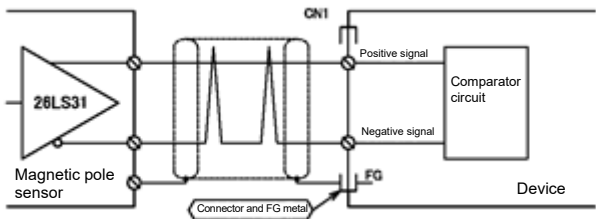
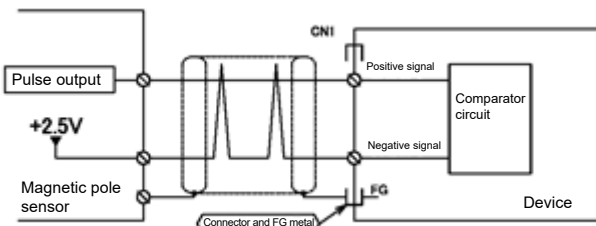
Connector	Electrical specifications												
CN1													
Corresponding signal													
Magnetic pole sensor input signal													
HA,HA*													
HB,HB*													
HC,HC*													
	<ul style="list-style-type: none">The pulse cycle (tw) must be at least 0.68 ms.The minimum edge distance (twab) between A-phase, B-phase, and C-phase must be at least 0.17 ms.												
	<p>[2-phase magnetic pole]</p> <ul style="list-style-type: none">The direction effective when the B-phase precedes the A-phase is assumed to be the positive direction.												
													
	<p>[3-phase magnetic pole]</p> <ul style="list-style-type: none">The direction effective when the device operates in the order of A-phase → B-phase → C-phase is assumed to be the positive direction.												
													
	Equivalent circuit												
	<p>[Line driver form]</p>												
													
	<table><tr><td></td><td>Positive signal</td><td>Negative signal</td></tr><tr><td>HA-phase</td><td>HA</td><td>HA*</td></tr><tr><td>HB-phase</td><td>HB</td><td>HB*</td></tr><tr><td>HC-phase</td><td>HC</td><td>HC*</td></tr></table>		Positive signal	Negative signal	HA-phase	HA	HA*	HB-phase	HB	HB*	HC-phase	HC	HC*
	Positive signal	Negative signal											
HA-phase	HA	HA*											
HB-phase	HB	HB*											
HC-phase	HC	HC*											
	<p>[Single-pole pulse command form]</p>												
													
	<table><tr><td></td><td>Positive signal</td><td>Negative signal</td></tr><tr><td>HA-phase</td><td>HA</td><td>HA*</td></tr><tr><td>HB-phase</td><td>HB</td><td>HB*</td></tr><tr><td>HC-phase</td><td>HC</td><td>HC*</td></tr></table>		Positive signal	Negative signal	HA-phase	HA	HA*	HB-phase	HB	HB*	HC-phase	HC	HC*
	Positive signal	Negative signal											
HA-phase	HA	HA*											
HB-phase	HB	HB*											
HC-phase	HC	HC*											
	Note: [Single-pole pulse command form] is supported by device Rev.3.00 or later.												

Table 4-3 Input/output interface (3/5)

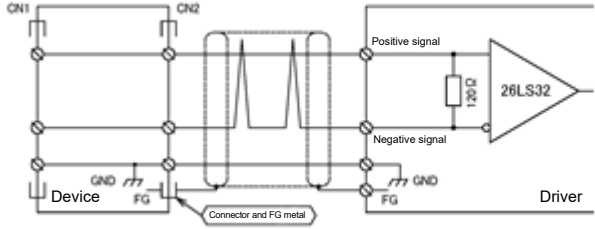
Connector	Electrical specifications												
CN2	<ul style="list-style-type: none"> Encoder pulse output signals to the driver are exactly the same as encoder feedback pulse inputs. 												
Corresponding signal													
Encoder, marker output signal 1													
EA1,EA1*													
EB1,EB1*													
EZ1,EZ1*													
	Equivalent circuit												
	 <table data-bbox="1149 486 1372 669"> <thead> <tr> <th></th><th>Positive signal</th><th>Negative signal</th></tr> </thead> <tbody> <tr> <td>A-phase</td><td>EA1</td><td>EA1*</td></tr> <tr> <td>B-phase</td><td>EB1</td><td>EB1*</td></tr> <tr> <td>Z-phase</td><td>EZ1</td><td>EZ1*</td></tr> </tbody> </table>		Positive signal	Negative signal	A-phase	EA1	EA1*	B-phase	EB1	EB1*	Z-phase	EZ1	EZ1*
	Positive signal	Negative signal											
A-phase	EA1	EA1*											
B-phase	EB1	EB1*											
Z-phase	EZ1	EZ1*											
	<ul style="list-style-type: none"> The terminating resistance on the receiving side must be 120 Ω (1/2 W or more). 												

Table 4-4 Input/output interface (4/5)

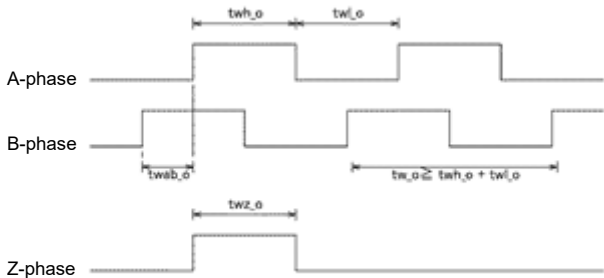
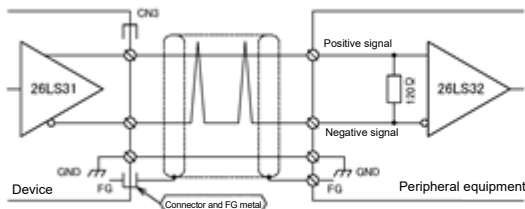
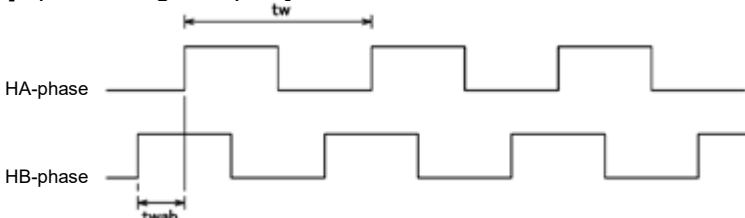
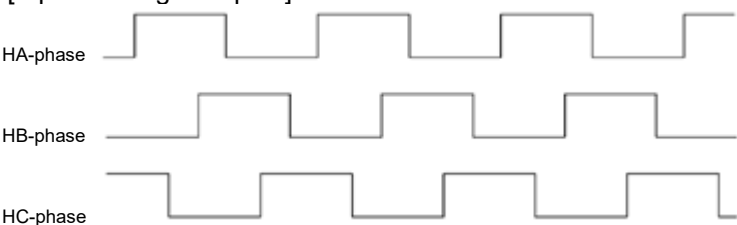
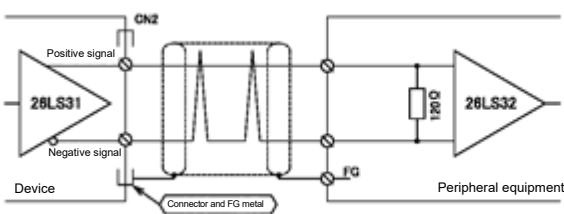
Connector	Electrical specifications														
CN3	Minimum output pulse width	t _{wh_o}	75 ns												
Corresponding signal		t _{wl_o}	75 ns												
Encoder, marker output signal 2	Minimum edge distance	t _{wab_o}	37.5 ns												
EA2,EA2* EB2,EB2* EZ2,EZ2*	<div></div>														
	<div><ul style="list-style-type: none">Encoder pulse output signals are synchronized with the operating frequency of 80 MHz (12.5 ns) inside the device. Thus, the output waveforms do not necessarily have a duty cycle of 50% and the edge distance is not constant.Select a sampling frequency that meets the following conditions: Sampling frequency > $\frac{1}{n \times 12.5 \text{ ns}} \times \text{Frequency dividing rate}$ $n = \frac{t - 12.5 \text{ ns}}{12.5 \text{ ns}}$ (Integer part, with any decimal places truncated) t: Encoder pulse input A-phase and B-phase minimum edge distance Example) A-phase and B-phase minimum edge distance: 120 ns Frequency dividing rate: 1/4 Then $n = \frac{(120 - 12.5)}{12.5} = 8.6$ Sampling frequency > $\frac{1}{8 \times 12.5 \text{ ns}} \times \frac{1}{4}$ Sampling frequency > 2.5MHzDepending on the length and the floating capacitance of the cable used, the pulse width and the edge distance input to the peripheral equipment may be shortened.For up to two seconds after power ON, it is indefinite.</div>														
	Equivalent circuit														
<div><div></div><div><table><tr><th></th><th>Positive signal</th><th>Negative signal</th></tr><tr><td>A-phase</td><td>EA2</td><td>EA2*</td></tr><tr><td>B-phase</td><td>EB2</td><td>EB2*</td></tr><tr><td>Z-phase</td><td>EZ2</td><td>EZ2*</td></tr></table></div></div>					Positive signal	Negative signal	A-phase	EA2	EA2*	B-phase	EB2	EB2*	Z-phase	EZ2	EZ2*
	Positive signal	Negative signal													
A-phase	EA2	EA2*													
B-phase	EB2	EB2*													
Z-phase	EZ2	EZ2*													
<div><ul style="list-style-type: none">A line driver (equivalent to 26LS31) is used for output. Thus, provide an interface using a line receiver (equivalent to 26LS32).The terminating resistance on the receiving side must be 120 Ω (1/2 W or more).</div>															

Table 4-5 Input/output interface (5/5)

Connector	Electrical specifications												
CN2													
Corresponding signal													
Magnetic pole sensor output signal													
HA1,HA1* HB1,HB1* HC1,HC1*	<div>[2-phase magnetic pole]</div> <div></div> <div>[3-phase magnetic pole]</div> <div></div> <div><ul style="list-style-type: none">The pulse cycle (tw) and the phase distance (twab) are equivalent to those of a magnetic pole sensor input signal.Output with the same pulse width as that of a magnetic pole sensor input. Depending on the length and the floating capacitance of the cable used, the pulse width and the edge distance input to the peripheral equipment may be shortened.</div>												
	Equivalent circuit												
	<div></div> <table><tr><th></th><th>Positive signal</th><th>Negative signal</th></tr><tr><td>HA-phase</td><td>HA1</td><td>HA1*</td></tr><tr><td>HB-phase</td><td>HB1</td><td>HB1*</td></tr><tr><td>HC-phase</td><td>HC1</td><td>HC1*</td></tr></table> <div><ul style="list-style-type: none">A line driver (equivalent to 26LS31) is used for output. Thus, provide an interface using a line receiver (equivalent to 26LS32).The terminating resistance on the receiving side must be 120 Ω (1/2 W or more).</div>		Positive signal	Negative signal	HA-phase	HA1	HA1*	HB-phase	HB1	HB1*	HC-phase	HC1	HC1*
	Positive signal	Negative signal											
HA-phase	HA1	HA1*											
HB-phase	HB1	HB1*											
HC-phase	HC1	HC1*											

4-5 Connectors to be used

The connectors to be used with this device are described below.

4-5-1 Encoder input connector (CN1)

The details of the encoder input connector (CN1) for this device are provided in Table 4-6 Encoder input connector (CN1).

Table 4-6 Encoder input connector (CN1)

No.	Signal code	Signal name	No.	Signal code	Signal name
1	GND	Internal control power supply ground	11	Z	Encoder marker signal input (positive pole)
2	GND	Internal control power supply ground	12	Z*	Encoder marker signal input (negative pole)
3	EP5	Encoder power supply (+5 V)	13	HA	Magnetic pole sensor input (positive pole)
4	EP5	Encoder power supply (+5 V)	14	HA*	Magnetic pole sensor input (negative pole)
5	NC	Not connected (reserved)	15	HB	Magnetic pole sensor input (positive pole)
6	NC	Not connected (reserved)	16	HB*	Magnetic pole sensor input (negative pole)
7	A	Encoder pulse A-phase input (positive pole)	17	HC	Magnetic pole sensor input (positive pole (for 3 phases))
8	A*	Encoder pulse A-phase input (negative pole)	18	HC*	Magnetic pole sensor input (negative pole (for 3 phases))
9	B	Encoder pulse B-phase input (positive pole)	19	NC	Not connected
10	B*	Encoder pulse B-phase input (negative pole)	20	NC	Not connected

Connector to be used : Receptacle /DF02R020NA3 (made by JAE) equivalent
Applicable cable side connector : Soldered plug /10120-3000PE (made by 3M) equivalent
: Case /10320-52A0-008 (made by 3M) equivalent

Figure below is connector alignment of the main unit side observed from the connecting block.

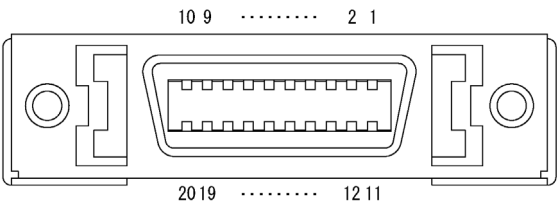
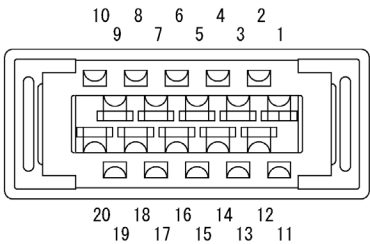


Figure below is connector alignment of the cable side observed from the soldering terminal side.



4-5-2 Encoder output 1 connector (CN2)

The details of the encoder output 1 connector (CN2) for this device are provided in Table 4-7 Encoder output 1 connector (CN2).

Table 4-7 Encoder output 1 connector (CN2)

No.	Signal code	Signal name	No.	Signal code	Signal name
1	GND	Internal control power supply ground	14	EZ1	Encoder marker signal output (positive pole)
2	GND	Internal control power supply ground	15	EZ1*	Encoder marker signal output (negative pole)
3	EP5	Encoder power supply (+5 V)	16	HA1	Magnetic pole sensor output (positive pole)
4	EP5	Encoder power supply (+5 V)	17	HA1*	Magnetic pole sensor output (negative pole)
5	NC	Not connected (reserved)	18	HB1	Magnetic pole sensor output (positive pole)
6	NC	Not connected (reserved)	19	HB1*	Magnetic pole sensor output (negative pole)
7	EA1	Encoder pulse A-phase output (positive pole)	20	HC1	Magnetic pole sensor output (positive pole (for 3 phases))
8	EA1*	Encoder pulse A-phase output (negative pole)	21	HC1*	Magnetic pole sensor output (negative pole (for 3 phases))
9	EB1	Encoder pulse B-phase output (positive pole)	22	NC	Not connected
10	EB1*	Encoder pulse B-phase output (negative pole)	23	NC	Not connected
11	NC	Not connected	24	NC	Not connected
12	NC	Not connected	25	NC	Not connected
13	NC	Not connected	26	NC	Not connected

Connector to be used : Receptacle /DF02R026NA3 (made by JAE) equivalent
 Applicable cable side connector : Soldered plug /10126-3000PE (made by 3M) equivalent
 : Case /10326-52A0-008 (made by 3M) equivalent

Figure below is connector alignment of the main unit side observed from the connecting block.

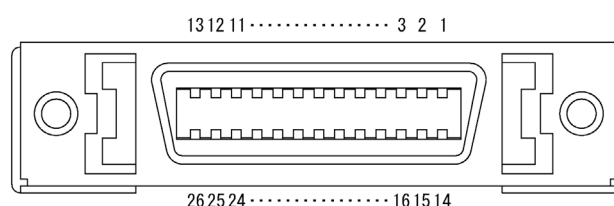
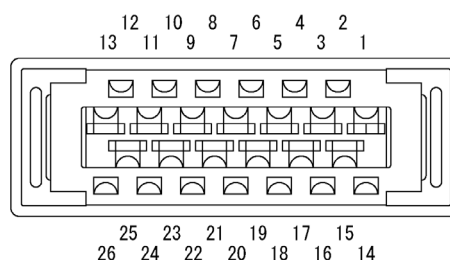


Figure below is connector alignment of the cable side observed from the soldering terminal side.



4-5-3 Encoder output 2 connector (CN3)

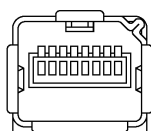
The details of the encoder output 2 connector (CN3) for this device are provided in Table 4-8 Encoder output 2 connector (CN3).

Table 4-8 Encoder output 2 connector (CN3)

No.	Signal code	Signal name	No.	Signal code	Signal name
1	EA2	Encoder pulse A-phase output (positive pole)	5	EZ2	Encoder marker signal output (positive pole)
2	EA2*	Encoder pulse A-phase output (negative pole)	6	EZ2*	Encoder marker signal output (negative pole)
3	EB2	Encoder pulse B-phase output (positive pole)	7	GND	Internal control power supply ground
4	EB2*	Encoder pulse B-phase output (negative pole)	8	GND	Internal control power supply ground

Connector to be used : Receptacle /MUF-RS8DK-GKXR (JST) equivalent
 Applicable cable side connector : Plug /MUF-PK8K-X (JST) equivalent

Figure below is connector alignment of the main unit side observed from the connecting block.



1 2.....8

4-5-4 Power supply terminal block (TB1)

The details of the terminal block (TB1) for the power supply for this device are provided in Table 4-9 Power supply terminal block (TB1).

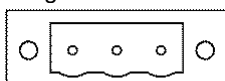
Table 4-9 Power supply terminal block (TB1)

No.	Signal code	Signal name
1	24 V	External power supply
2	NC	Not connected
3	0 V	External power supply common

Terminal block to be used : Socket /MSTB2,5/3-GF-5.08 (Phoenix Contact) equivalent
 Applicable cable side connector : Plug /MSTB2,5/3-STF-5.08 (Phoenix Contact) equivalent (supplied with the device main unit)

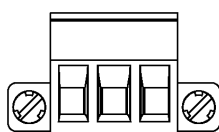
Recommended wire tightening torque : 0.5 to 0.6 N·m

Figure below is the alignment of the terminal block of the main unit side observed from the connecting block.



1 2 3

Figure below is the alignment of the plug observed from the cable insertion block.



1 2 3

Chapter 5 Outline

5-1 Outline	5-2
5-2 Name of each part	5-3

5-1 Outline

The outline of this device is shown in Figure 5-1 Outline drawing.

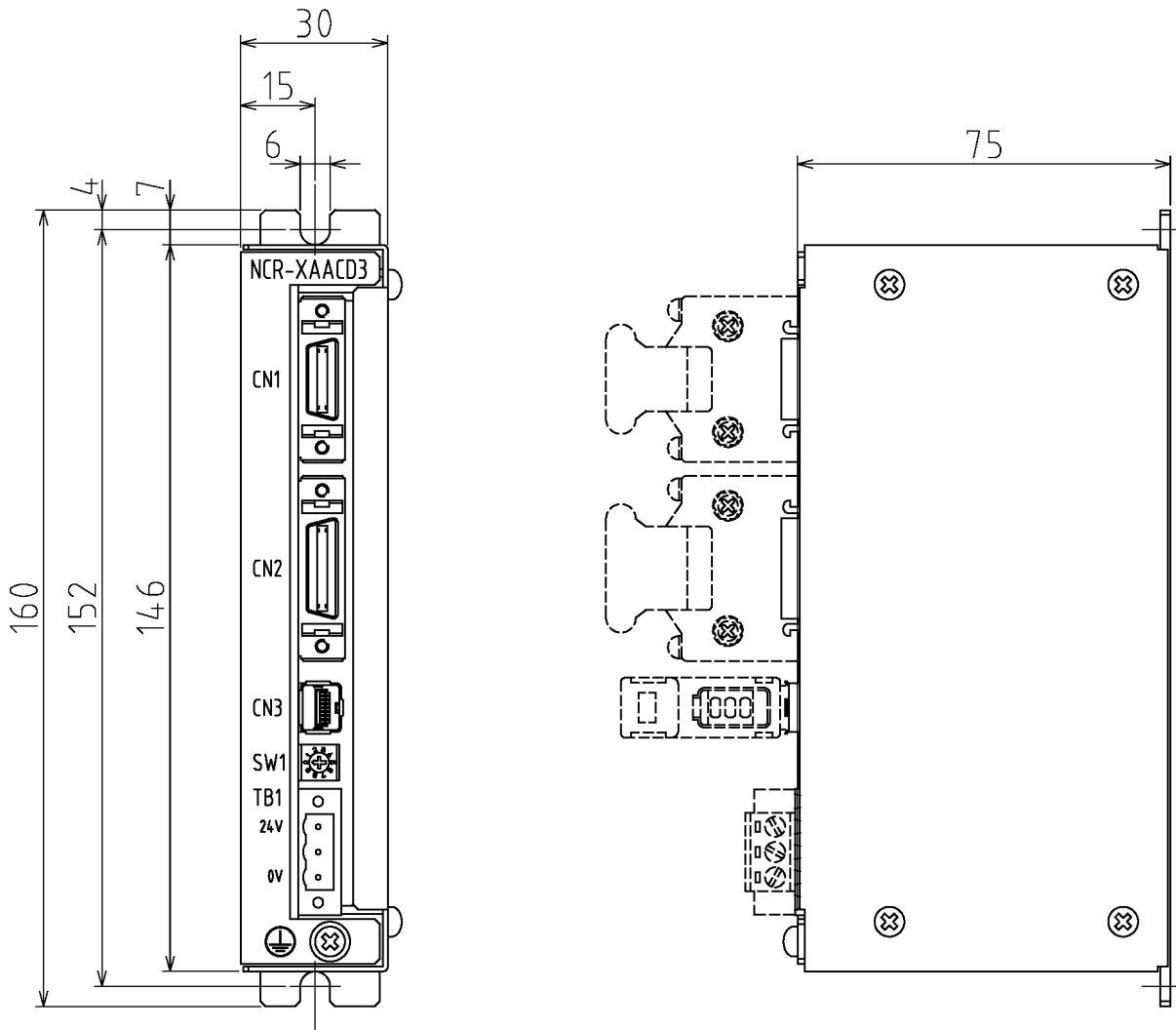


Figure 5-1 Outline drawing

5-2 Name of each part

An outline drawing of this device is shown in Figure 5-2 Outline drawing of the encoder distribution unit. The name and function of each part is listed in Table 5-1 Name and function of each part.

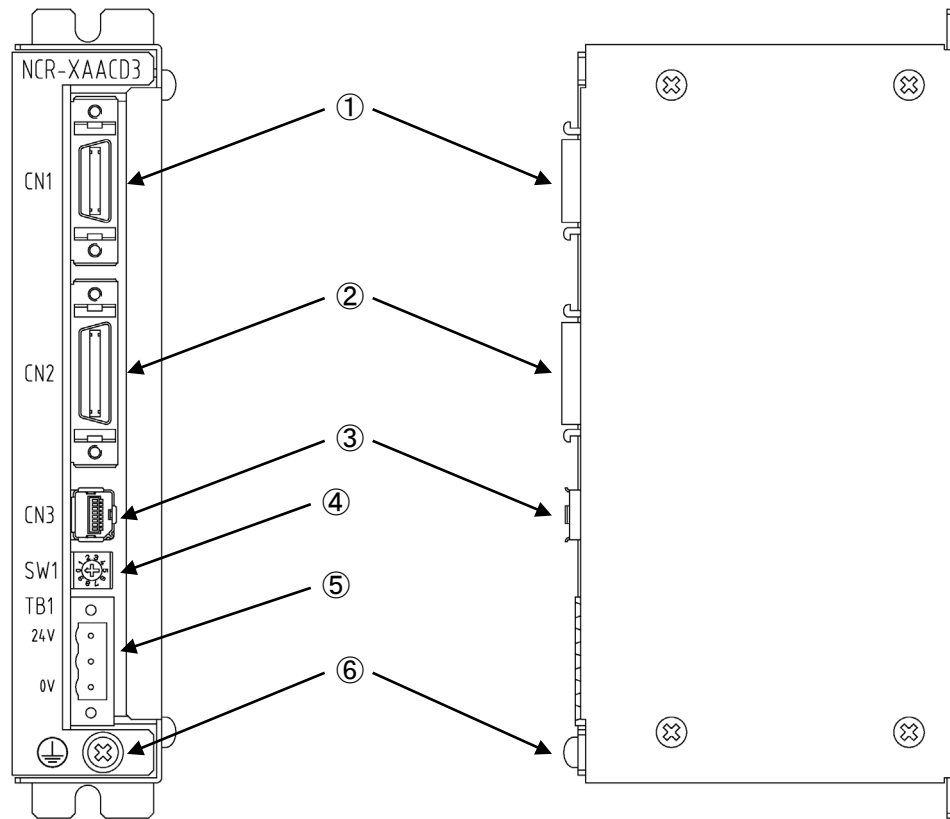


Figure 5-2 Outline drawing of the encoder distribution unit

Table 5-1 Name and function of each part

No.	Name	Code	Function
①	Encoder input connector	CN1	Connect the cable from the motor (encoder).
②	Encoder output connector 1	CN2	Connect the cable to the driver.
③	Encoder output connector 2	CN3	Connect the cable to the peripheral equipment.
④	Frequency dividing rate setting switch	SW1	Set the frequency dividing rate for signals to the peripheral equipment.
⑤	Connector for the external power supply	TB1	Connect the 24 VDC power supply.
⑥	Earth terminal	FG	Grounding terminal

Chapter 6 Setting

6-1 Encoder signal frequency division setting	6-2
6-2 Power supply switching setting	6-3

6-1 Encoder signal frequency division setting

For encoder output 2 (CN3), output by this device, a function for frequency dividing encoder signals is provided. This frequency-dividing function frequency-divides only the A- and B-phases; it does not frequency-divide the Z-phase.

Nine frequency dividing rates are available: 1/1, 1/2, 1/4, 1/8, 1/16, 1/32, 1/64, 1/128, and 1/256.

The frequency dividing rate can be switched with the rotary DIP switch, i.e., frequency dividing rate setting switch (SW1) ④ shown in Figure 5-2 Outline drawing of the encoder distribution unit.

The frequency dividing rates that can be set with the frequency dividing rate setting switch (SW1) are listed in Table 6-1 Setting values and frequency dividing rates.

It is recommended that such a frequency dividing rate be set that the maximum output frequency of encoder output 2 (CN3) multiplied by four does not exceed 1 Mpps.

Table 6-1 Setting values and frequency dividing rates

SW1	Frequency dividing rate	Remarks
0	1/1	
1	1/2	
2	1/4	
3	1/8	
4	1/16	
5	1/32	
6	1/64	
7	1/128	
8	1/256	
9 A : F	Reserved	Setting prohibited

6-2 Power supply switching setting

For the power supply for this device, the 5 VDC power supply from the driver (provided from CN2) and the 24 VDC power supply from TB1 are supported.

To switch between the power supplies, use the jumper socket of the jumper pin (JP1). The details are listed in Table 6-2 Power supply setting. The position of the jumper pin (JP1) is shown in Figure 6-1 Jumper pin (JP1) position.

Only the power supply for this device can be switched. The power supply for the encoder is always the 5 V power supply from the driver.

For information about the conditions (combinations) for using the external power supply, refer to "7-2 Combinations with motors (encoders) and encoder cables".

Table 6-2 Power supply setting

JP1 state	Power supply	Remarks
Pin 1 - Pin 2 jumped together	24 VDC power supply (provided from TB1)	
Pin 2 - Pin 3 jumped together	Provided from the driver (provided from CN2)	Factory setting

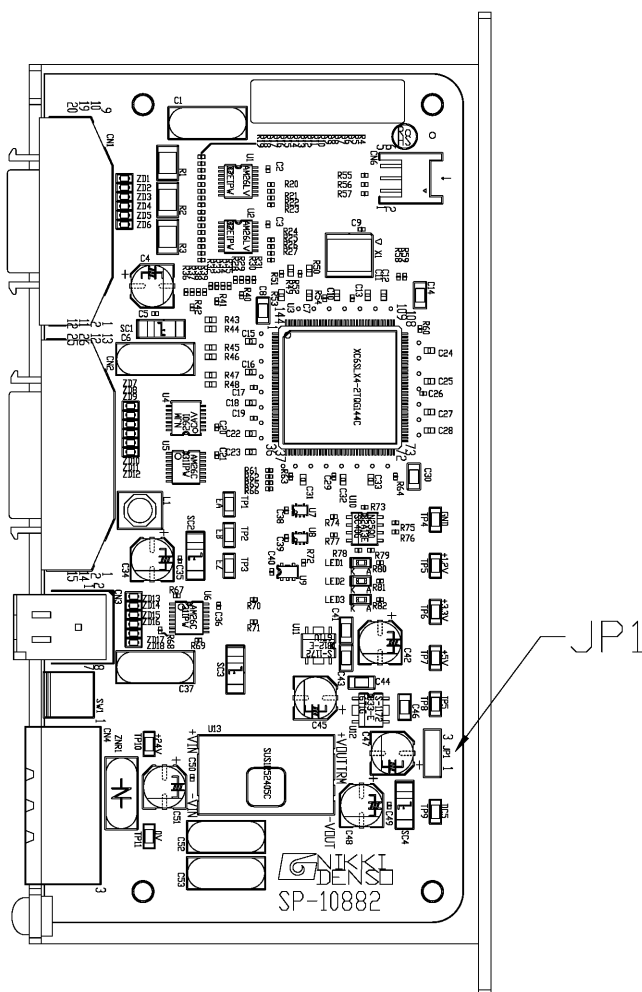


Figure 6-1 Jumper pin (JP1) position

Chapter 7 Combinational device

7-1 Combinations with drivers.....	7-2
7-2 Combinations with motors (encoders) and encoder cables	7-3

7-1 Combinations with drivers

The drivers that can be combined with this device are listed in Table 7-1 Combinational drivers.
Note: Combinations with the HA and HE Types are supported by device Rev.3.00 or later.

Table 7-1 Combinational drivers

Driver	Remarks
VPH Series HA Type	I/O Version
VPH Series HB Type	SSCNETIII(/H) supported version
VPH Series HC Type	CC-Link supported version
VPH Series HD Type	EtherCAT supported version
VPH Series HE Type	MECHATROLINK-III supported version

7-2 Combinations with motors (encoders) and encoder cables

Combinations of this device with motors (encoders) and encoder cables are listed in Table 7-2
Combinations with motors (encoders) and encoder cables.

Use an encoder cable with a length of 20 m or less.

Table 7-2 Combinations with motors (encoders) and encoder cables

Motor (encoder)	Encoder cable
τDISC (ND-S (INC) Series, DD-S Series, and HD-S Series)	NCR-XBGIA-*** NCR-XBCNA-***
τlinear (HEIDENHAIN encoder without magnetic pole sensor)	NCR-XBGAA-*** NCR-XBGAA-***-Z (*1)
τlinear (RENISHAW TONiC encoder without magnetic pole sensor)	NCR-XBGCA-*** NCR-XBGCA-***-Z (*1)
τlinear (RENISHAW TONiC encoder with magnetic pole sensor)	NCR-XBGBA-*** NCR-XBGBA-***-Z (*1) (*2)

*1: To use this cable, use the external power supply for this device (24 VDC power supply terminal block TB1).

*2: Supported by device Rev.3.00 or later.

Chapter 8 Option

- 8-1 Cables..... 8-2
 - 8-1-1 NCR-XBGSA-002 to NCR-XBGSA-010 8-3
 - 8-1-2 NCR-XBGTA-010 to NCR-XBGTA-030 8-4
- 8-2 Connector kit..... 8-5
 - 8-2-1 NCR-XBJ2A..... 8-5

8-1 Cables

The cables to be used with this device are shown in Figure 8-1 Diagram of cables to be used. The cables in the figure and their corresponding chapters are listed in Table 8-1 Table of cables and their corresponding chapters.

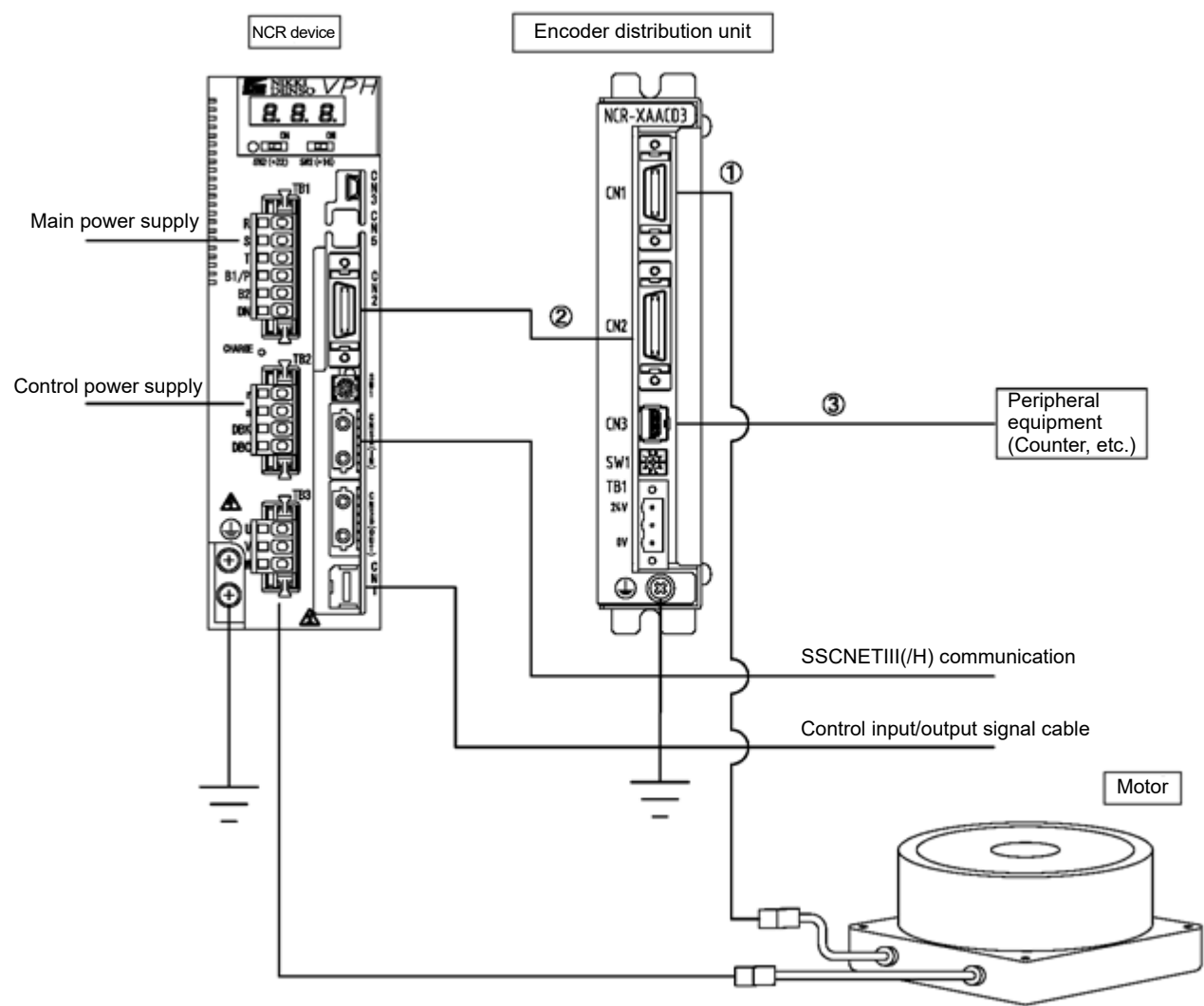


Figure 8-1 Diagram of cables to be used

Table 8-1 Table of cables and their corresponding chapters

Cable number	Chapter number
①	Refer to the Instruction Manual, VPH Series Option.
②	8-1-1 NCR-XBGSA-002 to NCR-XBGSA-010
③	8-1-2 NCR-XBGTA-010 to NCR-XBGTA-030

8-1-1 NCR-XBGSA-002 to NCR-XBGSA-010

A cable diagram of these cables is shown in Figure 8-2 NCR-XBGSA-*** cable diagram. The cables are listed in Table 8-2 NCR-XBGSA-*** cable list. The signals are listed in Table 8-3 NCR-XBGSA-*** cable signal table.

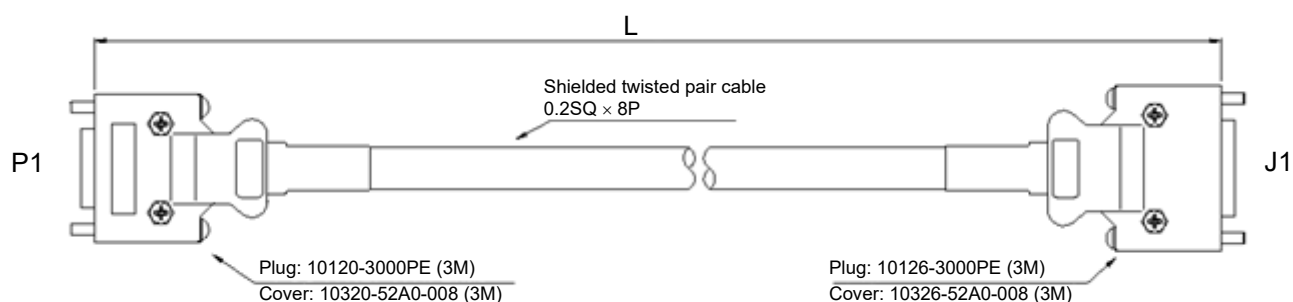


Figure 8-2 NCR-XBGSA-* cable diagram**

Table 8-2 NCR-XBGSA-* cable list**

Product model	Product code	Cable length L [mm]	Tolerance [mm]
NCR-XBGSA-002	256-7910	200	-0 +30
NCR-XBGSA-005	256-7920	500	-0 +30
NCR-XBGSA-010	256-7930	1000	-0 +30

Table 8-3 NCR-XBGSA-* cable signal table**

Signal name	P1 Pin No.	J1 Pin No.	Signal name	P1 Pin No.	J1 Pin No.
GND	1	1	Z	11	14
GND	2	2	Z*	12	15
+5 V	3	3	HA	13	16
+5 V	4	4	HA*	14	17
A	7	7	HB	15	18
A*	8	8	HB*	16	19
B	9	9	HC	17	20
B*	10	10	HC*	18	21
			FG (earth)	Metal	Drain wire (1.25SQ, green)

8-1-2 NCR-XBGTA-010 to NCR-XBGTA-030

A cable diagram is shown in Figure 8-3 NCR-XBGTA-*** cable diagram. The cables are listed in Table 8-4 NCR-XBGTA-*** cable list. The signals are listed in Table 8-5 NCR-XBGTA-*** cable signal table.

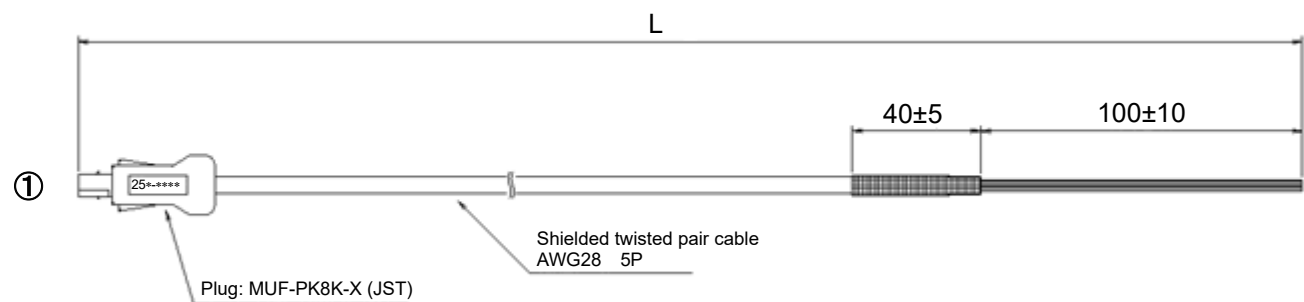


Figure 8-3 NCR-XBGTA-*** cable diagram

Table 8-4 NCR-XBGTA-*** cable list

Product model	Product code	Cable length L [mm]	Tolerance [mm]
NCR-XBGTA-010	256-7940	1000	±30
NCR-XBGTA-020	256-7950	2000	±30
NCR-XBGTA-030	256-7960	3000	±30

Table 8-5 NCR-XBGTA-*** cable signal table

Signal name	①Pin No.	Wiring color	
A	1	Orange	Red dot 1
A*	2	Orange	Black dot 1
B	3	Gray	Red dot 1
B*	4	Gray	Black dot 1
Z	5	Yellow	Red dot 1
Z*	6	Yellow	Black dot 1
GND	7	White	Red dot 1
GND	8	White	Black dot 1
FG	Metal	Drain wire (0.3SQ, green)	

8-2 Connector kit

8-2-1 NCR-XBJ2A

NCR-XBJ2A is a connector kit for making a connection from this device to peripheral equipment. Figure 8-4 NCR-XBJ2A connector kit diagram shows an outline drawing. Table 8-6 Product model and product code table lists the product model, product code, and JST product name.

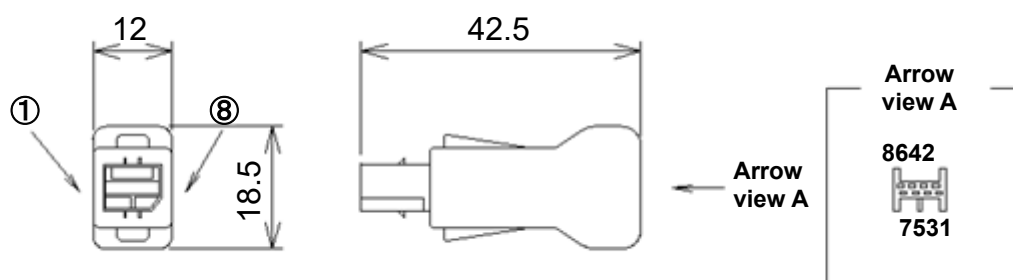


Figure 8-4 NCR-XBJ2A connector kit diagram

Table 8-6 Product model and product code table

Product model	Product code	JST product name
NCR-XBJ2A	256-7970	MUF-PK8K-X

For details of dimensions and so on, refer to the catalog data of JST.

For information about the pin arrangement of the signal to connect, refer to 8-1-2 NCR-XBGTA-010 to NCR-XBGTA-030.